CLAIMS

1   1.   A policer based on Random Early Detection (RED), comprising:

2   a filter that determines a filtered virtual time debt; and

3   a control law circuit that receives the filtered virtual time debt from the filter and

4   determines whether a packet should be dropped.

1   2.   The RED policer of claim 1, wherein a virtual time debt uses a time T in which a

2   packet is expected to arrive and is computed using a predetermined output transmission

3   rate.

1   3.   The RED policer of claim 2, wherein predetermined output transmission rate is

2   given by a traffic contract.

1   4.   The RED policer of claim 1, wherein the filter is based on an exponential

2   weighted moving average (EWMA) virtual time delay using the expression,

3         $EWMA_k = (1-g)EWMA_{k-1} + g(VTD)_k,$

4   where k indicates the presently received packet, and k-1 indicates the EWMA

5   computed when the last packet was received, the virtual time debt (VTD) is computed by

6   the expression: VTD = T(packet expected to arrive) − T(packet actually arrives), and g is

7   the gain of the filter.

1   5.   The RED policer of claim 1, further comprises a sampler that samples a virtual

2   time debt at a sampling interval, and transmits the sampled virtual time debt to the filter.

1   6.   The RED policer of claim 1, further comprises:

2   a random generator that generates a number based on the control law circuit's

3   determination as to whether a packet should be dropped; and

4   a counter that is set with the number generated by the random generator, wherein

5   the counter counts packets passing through the RED policer up to the set number, and

6   wherein the RED policer drops a packet when the counter has counted out the set num-

7   ber.

1   7.   The RED policer of claim 6, further comprises:

2   the control law circuit that determines a probability of a packet being dropped

3   based on the filtered time debt exceeding a predetermined minimum threshold,

4   and specifies a range of numbers based on the probability; and

5   the random generator that randomly generates a number in the range specified by

6   the control law circuit.

1   8.   A policer based on Random Early Detection (RED), comprising:

2   means for determining a moving average of a virtual time debt; and

3   means for determining whether a packet should be dropped based on a value of

4   the moving average of the virtual time debt.

1   9.   The RED policer of claim 8, further comprises means for sampling a virtual time

2   debt at a sampling interval, and transmitting the result to the moving average determining

3   means.

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1   10.   The RED policer of claim 8, further comprises:

2   means for generating a random number based on the result of the packet dropping

3   means; and

4   means for counting a number of packets passing through the RED policer up to

5   the random number generated by the random number generating means, wherein the

6   RED policer drops a packet when the counting means has counted out the generated ran-

7   dom number.

1   11.   A network device comprising:

2   a plurality of Random Early Detection (RED) policers, wherein each RED policer

3   includes,

4   a filter that determines a filtered virtual time debt; and

5   a control law circuit that receives the filtered virtual time debt from the

6   filter and determines whether a packet should be dropped; and

7   a packet classifier that determines which packet should go to which RED

8   policer.

1   12.   A method of policing packets in a network device, the method comprising the

2   steps of:

3   determining a filtered virtual time debt of a traffic;

4   comparing the filtered virtual time debt with a predetermined minimum threshold;

5   and if the filtered virtual time debt exceeds the minimum threshold, then

6   generating a random number that is used to determine which packet should to

7   dropped.

1   13.   The method of claim 12, wherein generating a random number further comprises

2   the steps of:

3   generating the random number in a range based on a level by which the filtered

4   virtual time debt exceeds the minimum threshold;

5   setting a counter with the random number; and

6   dropping a packet when the counter has counted out the random number.

1   14.   A computer readable medium having instructions contained therein, which when

2   executed by a computer performs a method comprising the steps of:

3   determining a filtered virtual time debt of a traffic;

4   comparing the filtered virtual time debt with a predetermined minimum threshold;

5   and if the filtered virtual time debt exceeds the minimum threshold, then

6   generating a random number that is used to determine which packet should to

7   dropped.

1   15.   The medium of claim 14, wherein generating a random number further comprises

2   the steps of:

3   generating the random number in a range based on a level the filtered virtual time

4   debt exceeds the minimum threshold;

5   setting a counter with the random number; and

6   dropping a packet when the counter has counted out the random number.

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9   16. Electromagnetic signals propagating over a computer network, said electro-

10   magnetic signals carrying instructions for practicing the method of claim 12.

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